

REMARKS

The Applicants thank the Examiner for the thorough consideration given the present application. Claims 18, 20, 23, and 35-38 are cancelled. Claims 1-7, 19, 21, 22, and 24-35 are pending. Claims 1, 4, 16, 19, 21, 22, 24, 26, 28, 29, and 35 are amended. Claim 1 is independent. The Examiner is respectfully requested to reconsider the rejections in view of the amendments and remarks set forth herein.

Drawings

It is gratefully appreciated that the Examiner has accepted the drawings.

Claim for Priority

The Examiner has acknowledged the Applicants' claim for foreign priority based on Singapore Patent Application No. 2002-06099-4.

Information Disclosure Citation

The Applicants thank the Examiner for considering the reference supplied with the Information Disclosure Statements filed January 8, 2004 and January 3, 2006, and for providing Applicants with initialed copies of the PTO forms filed therewith.

Restriction Requirement

The Examiner has made the Restriction Requirement final, and has withdrawn claims 37 and 38 from further consideration. By this Amendment, the Applicants have cancelled non-elected claims 37 and 38. The Applicants reserve the right to file a divisional application directed to claims 37 and 38 at a later date if so desired.

Rejection Under 35 U.S.C. § 112, second paragraph

Claims 1-36 stand rejected under 35 U.S.C. § 112, second paragraph. This rejection is respectfully traversed.

The Examiner has set forth certain instances wherein the claim language is not clearly understood.

In order to overcome this rejection, the Applicants have amended claims 1, 4, 16, 21, 22, 26, 28, and 35, and have cancelled claims 18, 20, 23 and 36 to correct each of the deficiencies specifically pointed out by the Examiner. The Applicants respectfully submit that the claims, as amended, particularly point out and distinctly claim the subject matter which the Applicants regard as the invention. Accordingly, reconsideration and withdrawal of this rejection are respectfully requested.

Rejections Under 35 U.S.C. §103(a)

Claims 1-4, 11-14, 16-21, 23-26, 28-31, and 33-36 stand rejected under 35 U.S.C. §103(a) as being unpatentable over GB 2161647 in view of Sandhage (U.S. 5,318,725) and further in view of Fernandez et al.;

claims 5-10 and 15 stand rejected under 35 U.S.C. §103(a) as being unpatentable over GB 2161647 in view of Sandhage (U.S. 5,318,725) and further in view of Fernandez et al.;

claim 22 stands rejected under 35 U.S.C. §103(a) as being unpatentable over GB 2161647 in view of Sandhage (U.S. 5,318,725) and further in view of Fernandez et al.;

claim 27 stands rejected under 35 U.S.C. §103(a) as being unpatentable over GB 2161647 in view of Sandhage (U.S. 5,318,725) and further in view of Fernandez et al.; and

claim 32 stands rejected under 35 U.S.C. §103(a) as being unpatentable over GB 2161647 in view of Sandhage (U.S. 5,318,725) and further in view of Fernandez et al.

These rejections are respectfully traversed.

Arguments Regarding Independent Claim 1

Independent claim 1 remains unchanged except for the amendments to address the issues under 35 U.S.C. 112, second paragraph.

The Applicants respectfully submit that the combination of method steps as set forth in independent claim 1 is not disclosed or made obvious by the prior art of record, including GB 2161647 in view of Sandhage (U.S. 5,318,725) and further in view of Fernandez et al.

It is known that glass-like sintering agents (or called sintering aids) need be introduced to a piezoelectric ceramic thick film in order to achieve a piezoelectric thick film at a lower temperature. In GB2161647A, powder of glass-like binding agent was added to the piezoelectric ceramic powder (Pg 1, Line 98; Pg 2, Line 48). However, the homogeneity achieved through mechanically mixing the powder of the binding agent with piezoelectric ceramic powder is limited, particularly when the amount of the binding agent is small.

In contrast, the method for introducing the binding agents is different in the present invention, in which the binding agent (metal oxide of low-melting point) is introduced through a liquid phase precursor. The liquid phase precursor is mixed with the powder of

piezoelectric ceramic and then the liquid precursor is precipitated and decomposed into the desired binding agents during the subsequent annealing process.

GB 2161647 (Pg 2, Line 66-73), merely discloses that “if there is too little agent the finished transducer will be powdery and not hard wearing,” and the ratio by weight of piezoelectric ceramic powder to binding agent should be from 1:1 to 5:1.” However, in the present invention the “total amount of the metal oxide (the binding agent) in the thick film is between 1% and 5% by weight (Claim 14).” Thus, GB 2161647 fails to teach the method as set forth in independent claim 1.

Further, U.S. 5,318,725 discloses some sintering aids (col. 3, Lines 1-5), but does not teach any method about mixing the piezoelectric ceramic powder with any liquid phase precursor of a metal oxide of low melting point. Nothing is disclosed about the decomposition of the precursor into the metal oxide, as in the present claim 1. In U.S. 5,318,725, the “liquid-phase sintering aids” merely discloses that the sintering aids become a liquid phase to promote the sintering during the final high temperature annealing stage, but this has nothing to do with liquid phase mixing at the stage of preparing the paste of the present invention.

In addition, Fernandez et al. do not disclose any process of preparing the ceramic film by introducing sintering aids. This ceramic thick film processing is powder-based.

Without the liquid phase mixing method to introduce the sintering aids, the films obtained in the present invention cannot be realized through any combination of GB 2161647, U.S. 5,318,725 and Fernandez et al.

At least for the reasons explained above, the Applicants respectfully submit that the combination of method steps as set forth in independent claim 1 is not disclosed or made obvious by the prior art of record, including GB 2161647 in view of Sandhage (U.S. 5,318,725) and further in view of Fernandez et al.

Therefore, independent claim 1 is in condition for allowance.

Dependent Claims

The Examiner will note that dependent claims 4, 16, 19, 21, 22, 24, 26, 28, 29, and 35 are amended. All dependent claims are in condition for allowance due to their dependency from allowable independent claims, or due to the additional novel features set forth therein.

Regarding Dependent Claims 7-10 and 15:

The present method introduces the sintering aids through liquid phase, and obtains the liquid phase of the precursors containing Li and Bi. Claims 7-10 and 15 are related to how to obtain the solutions containing Li and Bi so as that they can be introduced through a liquid phase. In all the cited references, the sintering agents, including Li₂O and Bi₂O₃, are mixed in powder form.

Regarding Dependent Claim 22

GB 2161647 and U.S. 5,318,725 merely introduce the sintering aids in the form of powder, not in the liquid phase as presently claimed.

Accordingly, reconsideration and withdrawal of the rejections under 35 U.S.C. §103(a) are respectfully requested.

CONCLUSION

Since the remaining patents cited by the Examiner have not been utilized to reject claims, but merely to show the state of the art, no comment need be made with respect thereto.

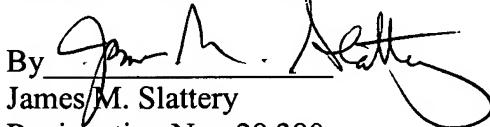
All of the stated grounds of rejection have been properly traversed, accommodated, or rendered moot. It is believed that a full and complete response has been made to the outstanding Office Action, and that the present application is in condition for allowance.

If the Examiner believes, for any reason, that personal communication will expedite prosecution of this application, he is invited to telephone Carl T. Thomsen (Reg. No. 50,786) at (703) 208-4030(direct line).

If necessary, the Commissioner is hereby authorized in this, concurrent, and future replies to charge payment or credit any overpayment to Deposit Account No. 02-2448 for any additional fees required under 37 C.F.R. §§1.16 or 1.17, particularly extension of time fees.

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Respectfully submitted,

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